The Mining Journal

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Railway & Commercial Gazette

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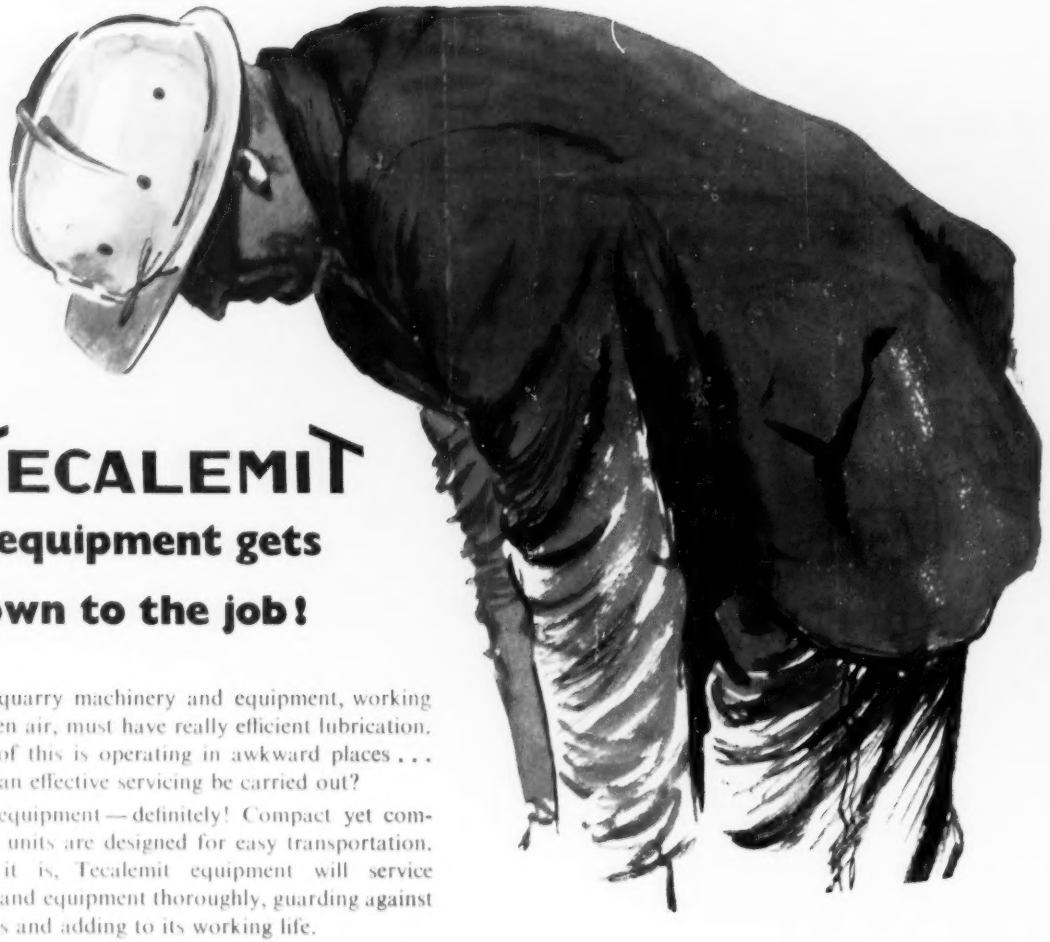

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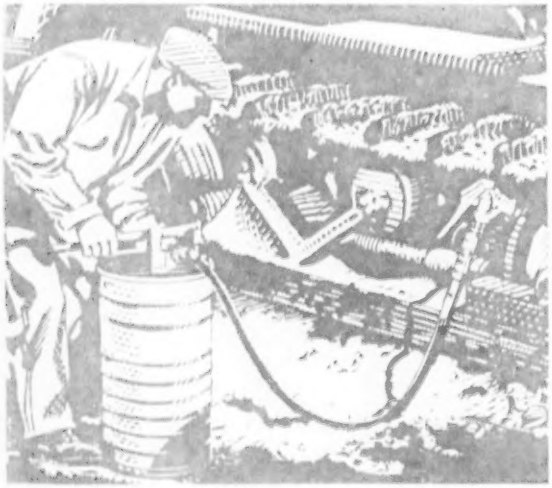

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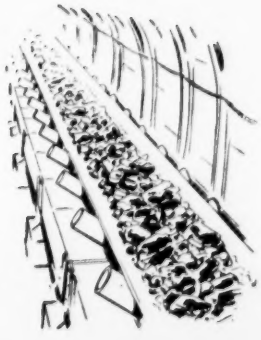

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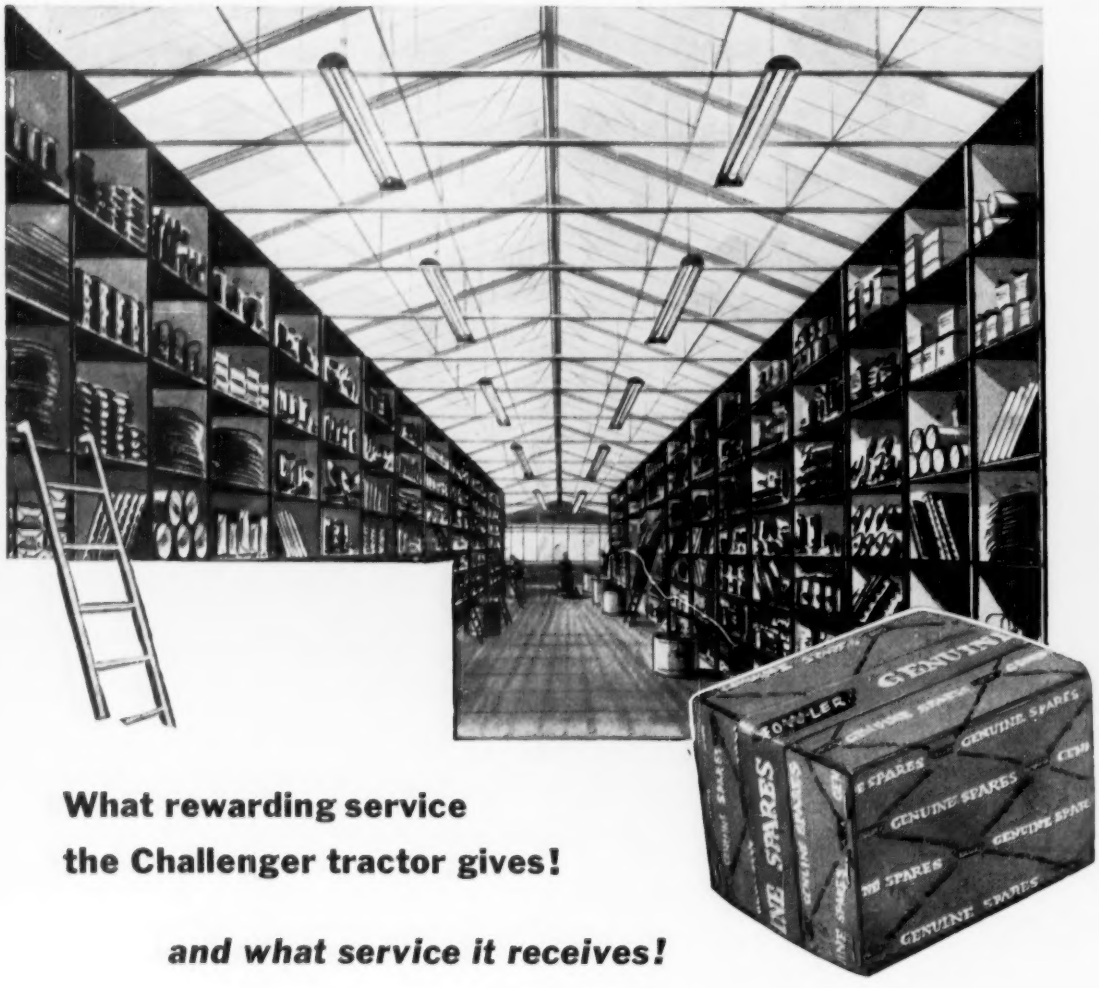

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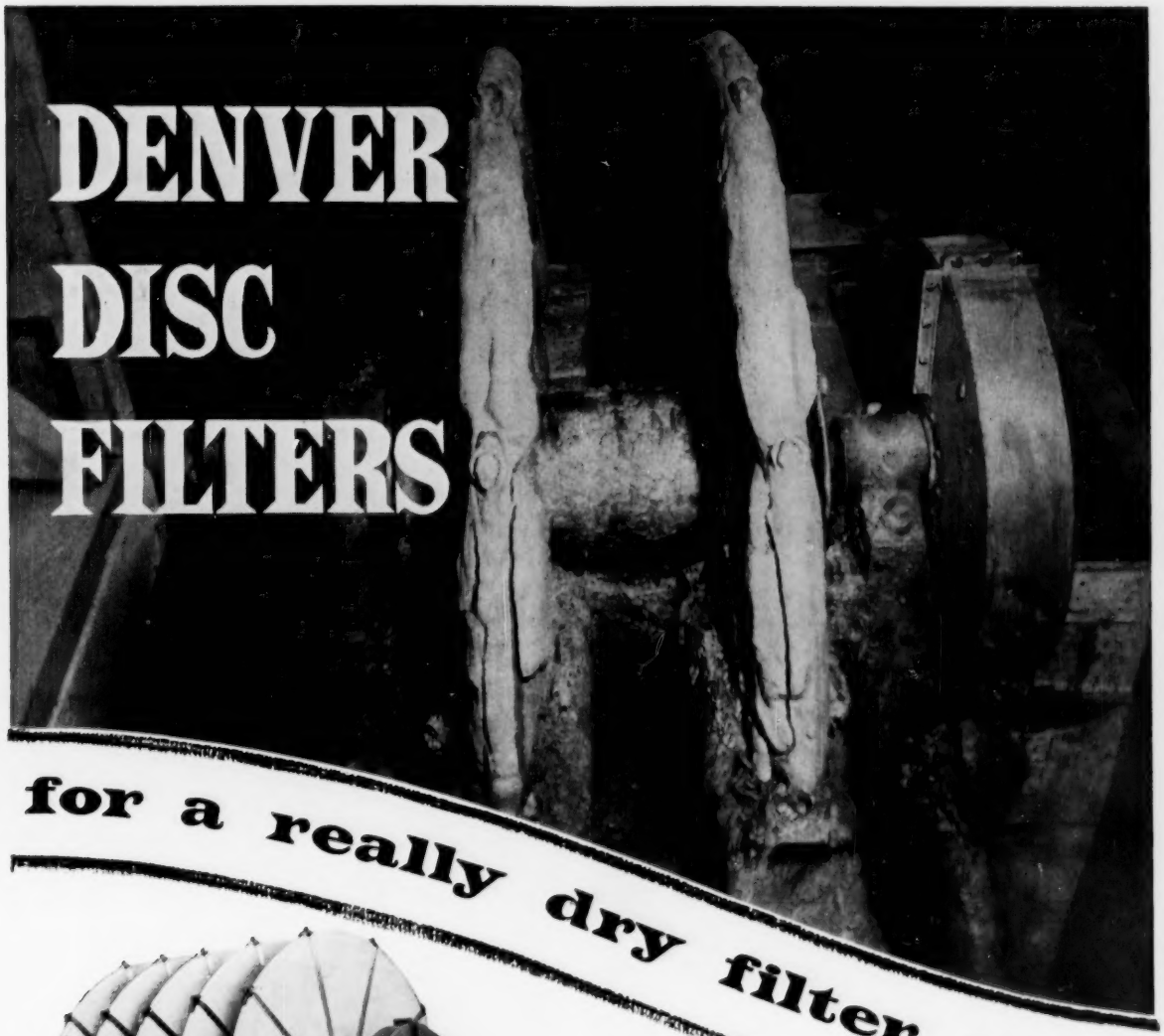

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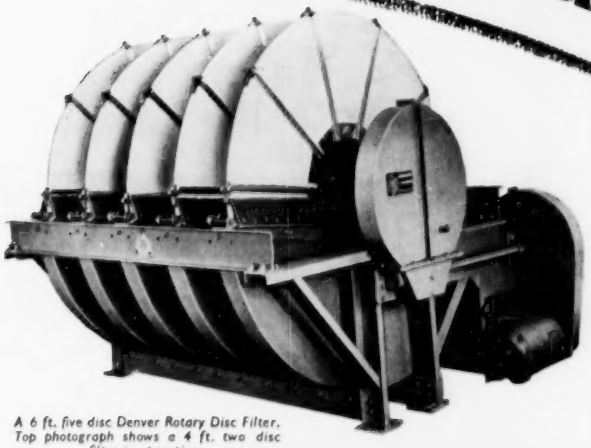

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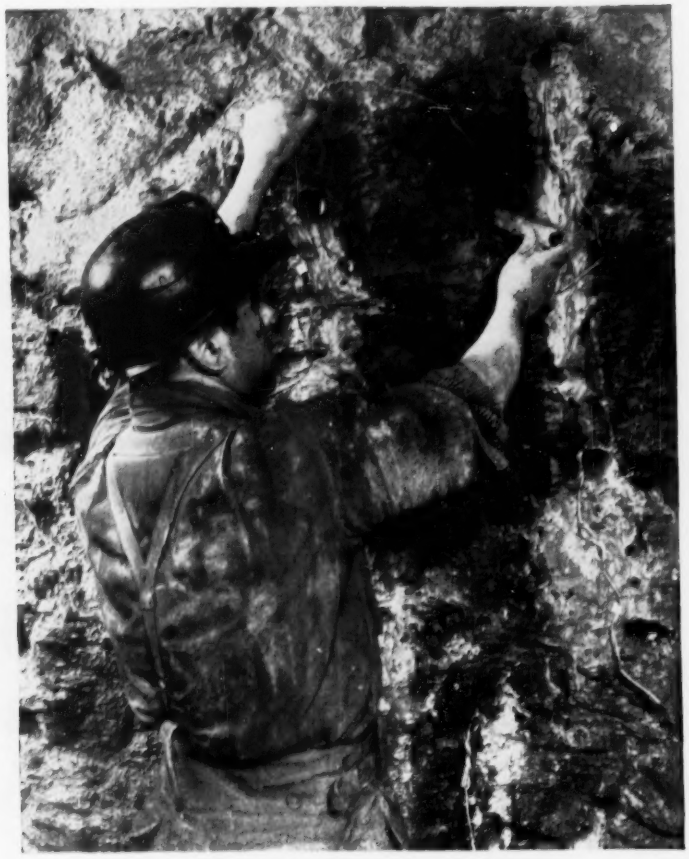

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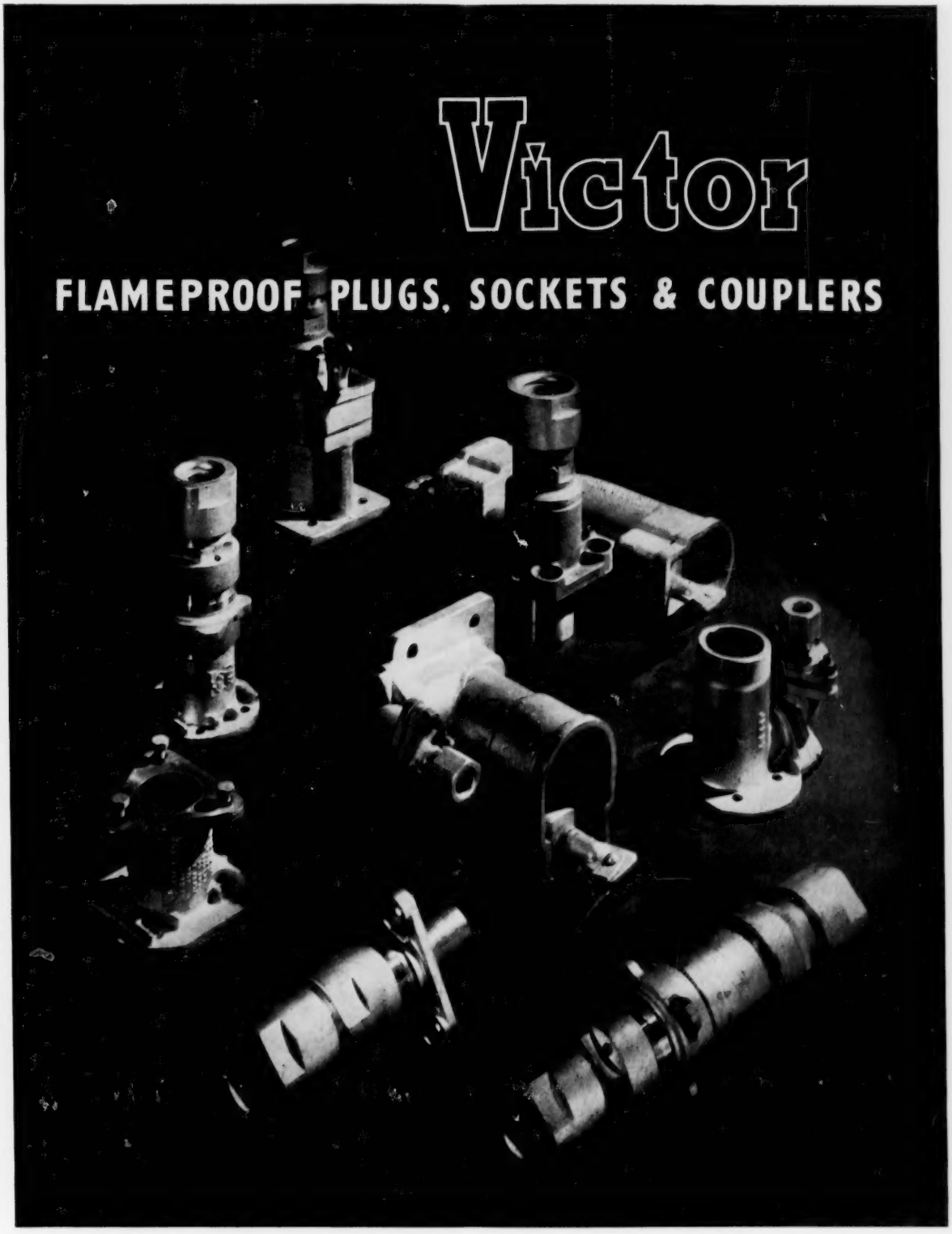

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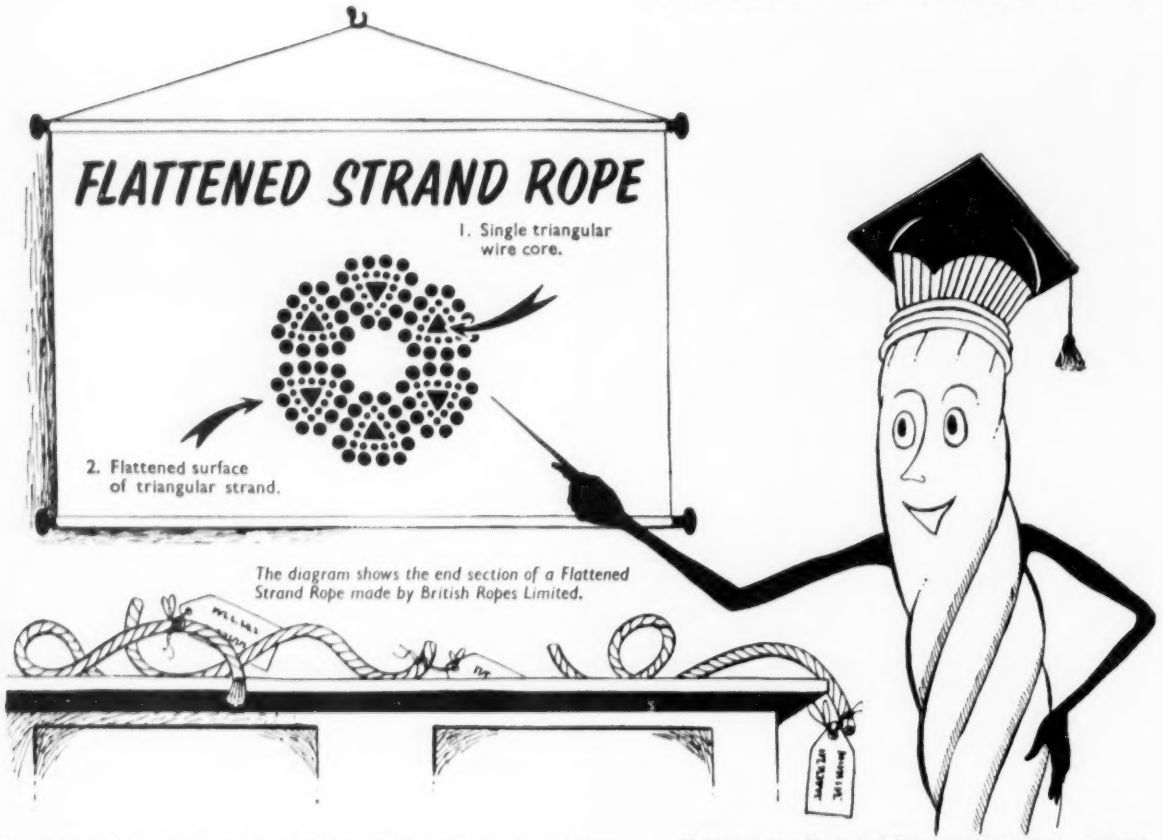

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Established 1835

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CONTENTS

Hail and Farewell ... 765
From Our Canadian Correspondent ... 769
The Loading and Transportation of Rock in Driving Small Tunnels ... 770
Future Fuel Supplies in the U.K. ... 772
Radio Link Aids Cementation Operation ... 773
Underground Dump Haulage on Incline ... 774
Technical Briefs ... 775
Reviews ... 775
Company News and Views ... 776
Company Meetings and Announcements ... 777
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Hail and Farewell

Looking back on 1955 from a point in time sufficiently distant to give some perspective to the view, shall we see it as the year in which the threat to world peace receded so dramatically as to justify the inelegant, but none the less widely quoted forecast of a British Cabinet Minister that "there ain't gonna be any war?" Or will 1955 go down as the year in which statesmen from both sides of the Iron Curtain showed themselves avid for friendship at any price, provided it was their own?

Probably the truth—as it usually does—lies somewhere between the two extremes. If the year ended with conflicting claims for the rather dubious distinction of having produced the world's biggest-ever "bang," it also brought the Geneva Conference on the peaceful uses of atomic energy and a commendable competition among the nuclear nations, if we may so call them, to spread the benefits of this new source of power among countries less favourably situated—always subject, of course, to the overriding requirements of security regulations. The cold war, if it has given unwelcome reminders of its continued existence, has also manifested itself by a lavish outpouring of financial and technical assistance in attempts to secure the friendly co-operation of strategically important countries. Clearly it is an ill wind indeed which blows no oil sheik any good!

Whatever the verdict of history on the year now drawing to its close, it seems evident that the mining industry can look forward to a high level of demand throughout 1956. The ideological war will doubtless continue to vary in temperature, but the world will go on requiring ever greater quantities of minerals and metals, whether for military purposes, for the expansion of industrial uses, or—most probably—for both.

America's growing dependence on importation for the bulk of its mineral requirements has long been recognized by the U.S. Administration. Despite certain apparent inconsistencies, the Administration has a positive minerals policy backed by the statistical and research facilities of the U.S. Bureau of Mines.

The twin pillars of minerals policy in the U.S. are, of course, to achieve maximum self-sufficiency by encouraging the domestic production of ores and metals and to ensure that requirements which cannot be domestically supplied are adequately provided for by importation and stockpiling. To an increasing extent these basic principles are influencing tariff and stockpiling policies and the siting of reduction plants.

The metal mining industry in the U.S. has been described as fighting for survival on many fronts against rising costs of production, world competition, excessive imports, foreign aid and political influences. Among the most serious problems with which it is confronted are the depletion of easily accessible high-grade reserves and the difficulties encountered in the research for and mining of lower grade ores—both of them problems by no means peculiar to the U.S. Technical aid is therefore a major factor in the Government's mineral policy. While stockpiling, quite aside from its strategic implications, continues to be regarded as a form of assistance to the domestic mining industry.

While producers and shippers in other countries cannot be expected to welcome the emphasis on self-sufficiency in U.S. mineral policy, there is reassurance in the reflection that there are few minerals in which a condition remotely approaching independence can conceivably be achieved. Moreover, the expansion of domestic production, generally speaking, has so far been more than offset by increased consumption. Then, too, there are other markets which, though individually far smaller than the U.S., collectively could ultimately offer even greater prospects of expansion, having regard to the rate at which living standards are tending to rise throughout the world.

Throughout the year now ending the demand for nearly all strategic metals remained at peak levels in the U.S., but improved supplies and reduced stockpiling activity were reflected by the greater availability of some materials for civilian use. In the case of magnesium, for example, civilian consumption for the first time exceeded purchases on Government account.

With the U.S. economy running at full stretch diamond sales in 1955 may well establish a new all-time record. Prospects remain bright for both gem and industrial stones although any easing of purchases for the stockpile could alter the situation.

So far as the L.M.E. metals are concerned, the year is

closing on a bullish note with demand continuing firm and prices high. The underlying reason for copper's new peak of £404 a ton is the overall world shortage caused by major stoppages of production in a year of rising demand. The expectation is that, in the absence of labour troubles, supply and demand will be more in balance during 1956, but it remains to be seen what the price will be, bearing in mind that only a very small improvement in the supply position could bring it down quite sharply. As Mr. R. L. Prain has recently pointed out, the price of copper could fall by £150 a ton from its present level without causing a loss in production of more than about 10 per cent. In other words, an overwhelming majority of copper producers could see the price down to well below 30 c. and still make a profit.

Heavy demand, particularly from the tinplate and motor industries, in conjunction with the unrest in Malaya and the Middle East, American stockpiling, and various other factors, has led to a remarkable show of strength by tin. It is common knowledge that at the present time there is not sufficient tin, after allowing for American Government purchases, to replenish stocks and at the same time meet consumers' growing demands. Any hold-up in the arrival of metal, from whatever cause, could thus have the effect of raising prices to even higher levels. Now that the International Tin Agreement only awaits ratification by Indonesia, the coming year might be expected to see the closing down of the Texas smelter, but the confused political situation in Indonesia introduces an element of uncertainty into the future outlook.

On both sides of the Atlantic the demand for lead and zinc remains very firm, although there seems to be an element of danger in the extent to which both these metals —and, to a lesser extent, many others—are dependent on the motor car industry. From the U.S. come disturbing reports of cuts in production and competition among car dealers and salesmen for business at almost any price. Neither here nor in the States does the industry itself seem unduly perturbed at the possible approach of saturation point; in fact, very large expansion programmes are proceeding in the U.K. and elsewhere. In view of the repercussions of any set-back to this major industry on the entire metal situation, it is to be hoped that the confidence of the motor car manufacturers is not misplaced. Certainly the post-war achievements of the industry suggest that its leaders are fully capable of reading the signposts correctly.

Aluminium, unlike Alexander, keeps finding new worlds to conquer and increasing quantities are continually being called for as new horizons are discovered. An interesting feature of the latest U.S. expansion programmes is that due to the exhaustion of convenient sources of hydro-electric power the aluminium industry is turning to coal as the source of electric power for some of the latest projected plants. It is early to assess the implications of this trend and its effects on aluminium *vis-à-vis* competitors.

A feature of the year was the persistent demand for silver, which rose to the highest peak recorded since the spring of 1920. Whether the price will continue its upward trend depends on the U.S. Treasury, which can now legally unload the metal from its stocks, estimated to be in the region of 1,400,000,000 oz. This reserve was amassed under the provisions of the Silver Purchasing Act, which requires the American Treasury to buy U.S. mines silver at 90½ c. and allow it to sell at 91 c. At the time of writing the price is firm at 90½ c.

So far as gold is concerned, perhaps the most notable aspect of a year characterized by considerable activity in the international bullion trade was the far greater use made of the London gold market than during 1954. Almost the whole of the Union's offerings was handled through London and South Africa's example was widely followed.

As trade once followed the flag, so now might it be said that roads, railways and industrial progress follow in the wake of prospecting and mining development. Nowhere is this more in evidence than in Canada, where there still appears to be no limit in sight to the immense potentialities for expansion. The opinion has been expressed that within the next quarter of a century the volume of commerce moving through the ports at the head of the St. Lawrence Seaway may closely approach that of the port of New York. Far to the north-west of the St. Lawrence work is proceeding on a billion dollar project to harness the waters of Northern British Columbia and the Yukon Territory as part of the plan to create a huge electro-chemical and metallurgical centre. Throughout the Dominion railways constructed to serve new mining fields are already carrying large tonnages of ore and have opened up hitherto inaccessible regions for further development.

As time goes on the Canadian gold mining companies, which are prevented by the fixed price of their product from holding out hopes of substantial wage increases, are likely to be increasingly affected by the growing competition for labour from other mineral producers. There is already a tendency for labour to be drawn away from the goldfields by the more lucrative prospects offered by the rapid expansion of the uranium, iron ore and petroleum industries. Iron ore production is expected to rise within the next ten or fifteen years to 30-40,000,000 tons annually —a gross value of more than $300,000,000 a year. Leaders of the uranium industry believe that by 1957 Canada will be producing this material to the tune of $200,000,000 worth annually and will be by far the largest source of supply. Supreme confidence exists that there will be no slackening in the demand for uranium within the foreseeable future and no difficulty is being experienced in financing the principal enterprises. Scarcely less impressive are the scale and speed with which energy and capital are being applied to the development of the Dominion's extensive resources of lithium, titanium, petroleum and natural gas. Yet the most outstanding feature of Canada's seemingly never-ending mining boom is the firmness of the economic foundation on which it rests, which in itself is sufficient justification for long-term planning on the largest possible scale.

In the Union of South Africa the mining industry may be about to enter upon a new chapter of its colourful history. For a number of years interest has been focused largely on the development of the Orange Free State and Klerksdorp goldfields and the expansion of uranium production. The task of opening up new goldfields in arid and sparsely populated areas and providing them with water, power and transport makes formidable demands on the resources of the mining houses and the South African Government.

Now that major capital expenditure programmes are near completion, the time is doubtless at hand when the mining houses will be in a position to take another bite at the golden apple. For investors in search of pastures new, one of the most significant events of 1955 may well have been the Government's proclamation, under the Natural Resources Act, of a very large area stretching from the Bethal-Trichard districts to the Heidelberg-Nigel districts. Next on the list for development appears to be the Bethel-Kinross area, where shaft sinking is expected to start early in 1956.

The changing pattern of financing gold mining undertakings in South Africa has had significant effects on tunnelling and shaft sinking practice. The very large amount of money needed to open up the O.F.S. and Klerksdorp fields —in the region of £12,000,000 per mine—exceeded the

amount of risk capital available. The balance had therefore to be found by the issue of interest-bearing loan stock. Seldom in mining history has time been worth more money, and in circumstances like these increased costs in development work and shaft sinking are justified so long as they do not exceed the monetary equivalent of the time saved. This has led to a close examination of tunnelling and shaft sinking practice. The results of these studies, besides contributing to recent South African records, may well represent contributions of permanent value to mining practice.

Formidable though they appeared, the technical difficulties associated with the development of the Free State gold field proved not incapable of solution by modern engineering skill. It remains to be seen whether the mining houses will be equally successful in solving the manpower problem, which at present appears to set the limit on possible expansion. So far as African labour is concerned the position showed some improvement, which has not been fully maintained in recent months; it is still an open question whether the supply can be stepped up to a level wholly commensurate with future requirements. Further headaches, destined perhaps to be even more persistent, are presented by the grave shortage of European manpower, now hampering the economic expansion of the Dominion as a whole, and by the lack of qualified staff.

With the approval of the Government the mining industry is seeking to alleviate its labour and management problems by recruiting miners and trainees from Britain, Western Europe and elsewhere and is offering free university training to suitable candidates. In order to accelerate the recruitment and flow of trained miners from Europe, arrangements have been made for their transport by special planes.

The recent improvements in labour and power supplies are reflected in the year's operations by the older Rand mines. The main interest in the monthly milling returns has centred, however, on the growing list of O.F.S. producers, although at this early stage a surer guide to eventual profitability is afforded by the quarterly development results.

It is estimated that by the end of the current year working profits from uranium will probably be at the rate of some £20,000,000 annually, with prospects of a further increase when all the Orange Free State plants are in full commission.

The growing momentum of industrial expansion continued to be reflected in an increasing search for metals. The greatest emphasis has been laid upon the need for base and strategic minerals, and comprehensive prospecting schemes have been put in hand. Activities have been centred particularly upon the African continent and in Canada, and it might well be that the coming year will see the fruits of these labours.

The prosperity of coal and base minerals producers in Southern Africa is critically dependent on the ability of the railways to handle the tonnages produced. Since the war exporters have been in the tantalizing position of losing lucrative markets because of the chronic shortage of rolling stock. South of the Limpopo the railways are now, however, in a somewhat easier position, and the increasing quantities of coal reaching the ports suggest that a revival of South Africa's export trade, which has been drastically affected by the shortage of bogies, may no longer be far off.

Rhodesian Railways have shown an improved ability to handle the Central African Federation's mineral traffic, but demands for new engines and rolling stock continued to outstrip supplies. March was a memorable month, in that for the first time in recent years Southern Rhodesia's industries received all the coal they needed, but thereafter the effects of the highly successful reconstruction at Wankie were largely nullified by failure of the railways to keep pace fully with increased production.

A significant consequence of railway bottlenecks and high freight charges in the Rhodesias has been a growing pressure on the territorial Governments to encourage the local processing of minerals, with special regard to chrome. The availability of hydro-electric power from the Kariba power scheme must undoubtedly lead in due course to the more intensive development of local smelting.

Irrespective of political considerations, it is evident that if the mining industry is to prosper and expand, means must be found of safeguarding—and reconciling—the conflicting interests of European and African workers. The African advancement programme and the rearrangement of African jobs on the Copperbelt are at any rate a constructive and realistic approach to a problem on which the future of the Federation quite as much as of the Copperbelt depends. Improved living standards for African workers can scarcely fail to be reflected by demands for progressively higher wages. In this respect the Copperbelt with its greater margin for absorbing wage increases, is more favourably situated than are the Rand's marginal gold producers.

Though the results of the year's operations are not as yet available, all signs point to further progress in the mining and economic development of the Belgian Congo. The outstanding event of 1955 was the conclusion of the new 10-year Belgian-American agreement, under which Belgium undertakes not to sell nuclear materials produced in her territories to countries other than Britain and the U.S. without an assurance that these materials will not be used for military purposes. In return, Belgium will be sold all the enriched uranium she requires for the peaceful application of nuclear energy and will also be given all technical information which may be necessary for this purpose.

Disturbances in North Africa held up a number of expansion projects, as was also the case in Cyprus, where it became necessary to send a strong Governor, Sir John Harding, to restore law and order. The year closes with the situation in Cyprus still confused, but recent statements hold out some grounds for the hope that progress towards an acceptable settlement is at last being made.

In Asia and the Far East the factors dominating the general trend of mining and economic development were the high price of tin, political uncertainty in various countries, and India's projects for the expansion of steel production. The Malayan tin industry has, of course, benefited from the recent heavy buying in the U.S. and the current state of the market augurs well for a favourable year in 1956. On the other hand, the political situation has been profoundly altered by the results of the Federal Elections, which are expected to lead to demands for immediate self-government.

It by no means follows that an acceleration of Malaya's progress towards a goal which, sooner or later was bound to be reached, will have adverse effects on industry, but it is clearly of prime importance that whatever regime may ultimately emerge from the political crucible should be fully aware of the country's critical dependence on tin and rubber. Perhaps the most disquieting aspect of political developments in the Far East is the widely held belief that Communists are not dangerous if they are of one's own race, an outlook which has had unfortunate consequences in Indonesia and has unquestionably contributed to the unhappy situation in Indo-China, whose mineral wealth has passed almost entirely into Communist hands.

The expansion of the steel industry and the development of non-ferrous metal resources are key factors in India's second Five-Year Plan, with its emphasis on heavy industry. One of the declared objectives of the recently formed

Bombay Metal Exchange is to assist the country in its efforts to achieve near self-sufficiency in non-ferrous metals, particularly copper and lead. A Ministry of Iron and Steel was set up during the year and will administer the three steel plants which are being erected with German, U.S.S.R. and British aid. Russia's economic *rapprochement* with India has been further strengthened by the recent tour of Marshal Bulganin and Mr. Khrushchev which, whatever its political results, has certainly been fruitful in terms of increased trade. It was followed by the announcement that the U.S.S.R. is to sell India 1,000,000 tons of steel during the next three years, as well as oil, mining equipment, and other goods. As 1955 closes we are thus presented with the disturbing spectacle of Russia casting her bread to some purpose on the troubled waters of the Far East. In what form, one wonders, will it return to her and after how many days?

As to Russia's own mining and economic progress, such light as is allowed to filter through the Iron Curtain brings us a picture which, however misty and incomplete, is beyond question one of expansion in almost every field. According to the British Iron and Steel Federation, crude steel production is expected to show an improvement of eight per cent over 1954 and pig iron of 14 per cent. Coal production will be seven per cent above last year's total and big increases in iron ore are also planned. It has been announced that in 1960 requirements for ore, including export demand, will total 150,000,000 tons, which would involve a rise of 300 per cent over the 1952 level. Extensive capital works have been included in the current Five-Year Plan. Assuming that the progress of the coal and steel industries is a reliable pointer to the general tempo of expansion, it is evident that in its approaches to Eastern countries the U.S.S.R. is leading from economic strength.

The size of the current gold output and the value of the total Russian gold holding are matters for informed speculation and intelligent guesswork. One recently published estimate places production at between 12,000,000 and 18,000,000 f.oz. a year. Although this may be a considerable over-estimate, all that can be said with assurance is that gold production is on a very large scale indeed and that the accumulated stock probably exceeds the combined gold holdings of all European countries. Clearly the U.S.S.R. would not give a high priority to the production of a commodity which it was not proposed to use. The logical conclusion is that, at the time deemed to be most appropriate, this huge reserve will be used either for purposes of economic warfare or for financing Russia's own future development in the normal way.

Australia's mining industry has had a year of mixed fortunes, in which the transience of the oil boom has been offset to some extent by the realization of uranium dreams. Here, too, there have been disappointments, but a few discoveries have blossomed into potentially large ventures, whose progress is being attentively followed. After nearly a decade of steady expansion gold production in Western Australia appears to have reached its peak and it seems evident that in the absence of new discoveries the present level of production cannot be indefinitely maintained, though the decline would doubtless be temporarily arrested by a stimulant in the form of either a higher gold price or a decrease in wage rates. Present indications, however, point to further attrition of the exiguous margin remaining to gold producers, due to the upward trend in wages and the cost of stores.

In British West Africa the political picture is tending to become blurred and it is not yet clear—in the Gold Coast at any rate—whether current rumblings will, in the long run, amount to much. Mining operations proceeded apace although rising costs have begun to take their toll of some of the marginal gold producers. Several of the tin/columbite producers in Nigeria were suddenly left high and dry last May when the U.S. ceased to either renew existing contracts or enter into fresh commitments for the purchase of columbite ore for the stockpile. Nevertheless, the outlook for columbium is generally considered to be good and once the present difficulties are surmounted demand should expand. Attention in Sierra Leone last year was focused on the argument between Consolidated African Selection Trust and the Sierra Leone Government under which Casts relinquished its mining rights over a portion of its large lease area for a cash consideration. This enabled the Sierra Leone Government to grant digging concessions to the Africans which may result in a lessening of illicit diamond mining activities.

On the other side of the Pacific, notably in Chile, inflation has become so rampant that the Chilean Government has found it expedient to insulate the copper mining companies from its effects by making arrangements for them to obtain their pesos requirements at a free rate. Although this places the companies in the theoretical position of being able to grant almost unlimited wage increases, the wave of strikes and threats of strikes with which the year is ending suggests that only the success of the Government's programme of wage and price stabilization can avert the prospect of further labour troubles. The World Bank has made it a condition of further help that inflation should be more vigorously attacked.

In order to encourage production, the Brazilian Government has extended for a further twenty years the 1934 decree, which protects proprietors and fossickers and grants special facilities to companies exploiting deposits of gold and sub-products. Although mineral production continues to be concentrated in the east, progress is gradually being made in overcoming the lack of transport facilities, which in many regions has hindered the development of known deposits.

In Bolivia there are indications that tin production continues its gradual decline, but presumably this prospect is less disturbing for the Government now that it is embarking on broadening the basis of its economy.

Mexico's mining industry, after a prolonged period of gradual decline attributable largely to lack of equipment and capital, at last shows welcome signs of revival and there are indications that the corner may have been turned. Copper mining has benefited from intermittent strikes in the principal producing countries, while there have also been substantial improvements in the outputs of gold and silver. The only important exception to the upward trend of mineral production is lead. The Mexican Chamber of Mines is increasing its pressure for tax relief, which seems urgently necessary if the exploitation of the country's wealth is to be effectively undertaken.

A plan to supply electricity to all the coastal areas of British Guiana is being considered by the colony's government. It is hoped that the project, estimated to cost 10,000,000 British West Indies dollars, would enable bauxite to be processed into aluminium locally instead of being shipped to Canada as at present. This in itself would be a major step forward in the development of a colony which has been something of a Cinderella. Demerara Bauxite have applied for a hydro-electric licence.

In the United Kingdom and Western Europe, where mining has become largely synonymous with coal and iron, problems are presented by the failure of the coal industry to meet the growing volume of demand. According to the Economic Commission for Europe, the present trend of tightness in the European coal market is likely to be prolonged. There appears to be little prospect of any significant improvement in the fuel situation in Britain until the National Coal Board's reconstruction programme an-

proaches completion or until atomic power becomes available on a commercial scale, and both these developments, unhappily, are as yet some distance off. There is no doubt that poor morale and discipline at the pits are major factors in the decline of British coal production. In so far as this is a reflection on the industry's subordinate leadership, excessive centralization of administration may be partially to blame. Certainly the Fleck report concerned itself primarily with top management, although the consequential impact of this on the mine managers improved capacity to manage—which is surely the central issue, has yet to be seen. Meanwhile the cost of bringing coal to Newcastle has contributed to the drain on gold and dollar resources.

The year closes with Britain still in the grip of the Butler credit squeeze, with international competition in the world's export markets becoming increasingly acute, and with metal prices generally at levels which offer attractive rewards for mining enterprise.

The Chancellor's policy of using the bank rate as a means of control appears to be having a favourable influence on the foreign exchange position, though it is early yet for its effectiveness to be reliably assessed.

No justification for nervousness whatsoever is to be found in the latest O.E.E.C. annual report on the U.S. economy. On the basis of evidence and forecasts, presented by senior Government officials, it is concluded that the boom in the U.S. is only now getting into its stride and that the period of inventory accumulation is likely to continue for some time.

Canada

(From Our Own Correspondent)

North Bay, December 9.

Petroleum production from Alberta recently attained the record output of 385,000 bbls. daily from 5,992 wells. Meanwhile, resources in natural gas are being revealed in very great volume. This has encouraged the federal government at Ottawa to enter into an agreement with the provincial government of Ontario, looking to the construction of a 30 in. trans-Canada gas pipeline from the Canadian west to the industrial east. Under the arrangement, Trans-Canada Pipe Lines Co. will itself provide upwards of $225,000,000 for construction of the line, while the federal government together with Ontario will contribute a further $118,000,000 to cover the building of the 700 miles in length across a "lean" section of Northern Ontario where customers will be few until further industries develop.

Arrangements have been completed for a $155,000,000 financing programme designed to provide Westcoast Transmission Co. with funds for building a 650 mile 30 in. gas pipeline in British Columbia, and designed to deliver 300,000,000 cu. ft. of Canadian gas daily into the U.S. Pacific Northwest. The utilization of natural gas in the volume thus being provided for is expected to add further impetus to general industrial development in the east as well as west of Canada, and also in the U.S. northwest. The manufacture of pipe for use in the various projects is itself developing into an industry of importance.

A new copper-producing area appears to be in the making, this time at Pitching Lake in the province of Saskatchewan. The new discovery is being explored by Glenn Uranium Mines by way of surface trenching and diamond drilling. A copper content ranging from a little under two per cent to some five per cent has been indicated in deposits having a width of 10 to 20 ft. and occurring under favourable geological conditions.

Testifying to the prosperity of the metal mines of Canada is the fact that, for the year 1955, dividend disbursement will exceed $150,000,000 compared with the former record of $145,000,000 attained in 1952. Meanwhile, never before in the history of the metal mining industry were so many new mines of importance being made ready for production, some to attain their goal in 1956 and others in 1957.

URANIUM DEVELOPMENT

Outstanding among the new enterprises which have already been financed to the extent of $85,000,000 for development and plant construction are Algom Uranium Mines, and Consolidated Denison Mines in the Blind River uranium field. The output of these two enterprises, on the strength of the plants now under construction, is expected to reach an annual rate of some $80,000,000, the output about equally divided between the two companies.

The Canadian government has contracted to buy some $388,000,000 in uranium from these two enterprises between now and 1962, and is believed to have strings attached to the further output beyond that date. A feature of big significance related to these two uranium mines is that the work to date suggests that in regard to tonnage to keep their plants running at full capacity will represent no problem for the next quarter century.

The concentrating plant which went into operation on Gaspe Copper Mines some eight months ago has reached a current rate of 3,000 tons daily, in one unit. The bringing in of the second unit designed to attain an aggregate of over 6,000 tons daily will be governed by the trend of mine development. In the meantime, the company's smelter is expected to go into operation during the closing week of 1955, designed to produce 70,000,000 lb. of copper annually.

Selco Exploration Co., wholly owned subsidiary of Selection Trust Ltd., of London, is engaged in the exploration of a number of interesting mining prospects in Canada and has projected a busy campaign for 1956.

Canada's output of asbestos will exceed 1,000,000 tons during 1955 with a value closely approaching $100,000,000. The former best record was in 1951 when $81,000,000 was received for 973,000 tons. Eight producing companies contribute to current output which is estimated to account for 65 per cent of the world's production.

Iron ore production for 1955 has exceeded earlier estimates and may exceed 14,000,000 tons, and with a value well in excess of $100,000,000. Indications point toward an increase of more than 25 per cent during 1956, and with a similar rate of increase to continue throughout the next five years.

INCO'S LARGE SCALE OPERATIONS

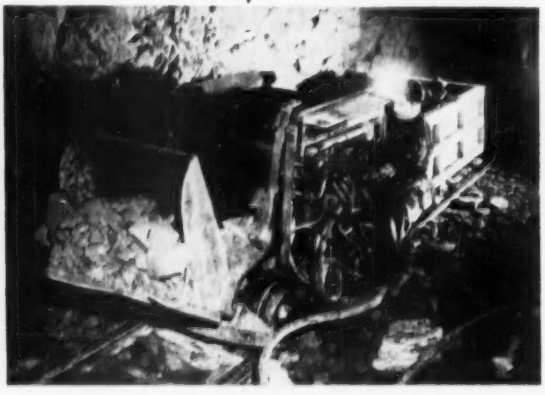
International Nickel Co. of Canada is now mining ore at a rate of over 15,000,000 tons a year. The sales of metal products which are chiefly nickel and copper are in the order of a daily average of around $1,000,000. As by-products of the nickel-copper ore, is an annual output of approximately 1,000,000 tons of iron, more than 1,000,000 oz. of silver, and with a yearly output of not far under 300,000 oz. of metals of the platinum group. Estimated ore reserves are in excess of 260,000,000 tons.

It is within less than 100 miles from the site of International Nickel operations that the new uranium mining field of Blind River is in course of development and where the outlook is that development will also ultimately reveal ore measured in terms of 200,000,000 to 300,000,000 tons—while another 100 miles to the west lie the widespread and big tonnage iron ranges of the Michipetcoten area.

The Loading and Transportation of Rock in Driving Small Tunnels

In *The Mining Journal* of June 19, 1953, notice was given of the *Manual of Rock Blasting* published by Aktiebolaget Atlas Diesel of Stockholm and Sandvikens Jernverks Aktiebolag, Sanviken, Sweden, which was presented as being probably the first complete treatise produced dealing with the scientific, technical and practical aspects of rock blasting in mining, tunnelling and excavating operations. A second volume of supplementary material has lately been received from Atlas Diesel—now Atlas Copco—and from the excellent selection of articles contained therein, the following condensation of that by V. Wanhainen is presented as being of specific interest. The article discusses the methods and equipment used in spoil removal during the driving of small tunnels.

Where time is of minor importance, experience has shown that short tunnels can be constructed most cheaply by choosing a cross-section of 19.4 to 21.5 sq. ft. and using extremely simple equipment. Loading should be performed *by hand*, using wheelbarrows or simple end- or side-dumping cars. Hoisting can be done with an ordinary 2-ton crane. All work, such as drilling, blasting and loading should be performed as far as possible by one man.



Atlas Copco LM200 mine loader at Malmberget

A cross-section of 19.4 to 21.5 sq. ft. is the smallest that can be worked conveniently and economically. For haulages exceeding 1,000 ft. in length, motorized transport should be employed; and where mechanization is adopted, the time factor assumes greater economic significance.

TUNNELLING BY MECHANIZED EQUIPMENT

If a tunnel is to be driven with completely mechanized equipment the question of the cross-section assumes a new aspect. No tunnel excavating equipment is available at present which can be accommodated within a sectional area of less than 5 ft. by 6.2 ft. The cross-section is determined by the space necessary for the working operations plus that required for the ventilating pipes, air, and water lines, track, etc.

In many cases, however, time alone decides the choice of working method. The rate of advance is also affected by differences in drillability and resistance to blasting of the rock. The difference is partly due to the drilling rate, which in softer types of rock is 2 to 3 ft. per minute with a drill bit of standard diameter. The advance is not dependent on drill penetration alone however, but also, and not least, on the system adopted for loading and tramming. An important factor is the organization of the working cycle: drilling-blasting-ventilation-tramming.

To facilitate the choice of suitable equipment, loading and transportation work in a 43 to 86 sq. ft. tunnel may be divided into the following operations, namely, shovelling and transferring muck to cars, car switching and haulage, and dumping.

Many loading machines are available.

Arc-type shovel loaders are usually compressed-air driven and track mounted. They are provided with a bucket which after being filled, throws the excavated material backwards into a mine car coupled to the loader. Machines of this type include Atlas Diesel LM types, Eimco loaders up to type 40, Joy HL types, Westfalia High-speed Loader, Goodman Conway Shovel 120-125, Salzgitter Loader HL 200-400, etc. The material is either thrown directly into the car or on to a belt conveyor for feeding into the cars.

Shovel loading machines are now available with a belt conveyor, but such machines are usually too large to use in small tunnels.

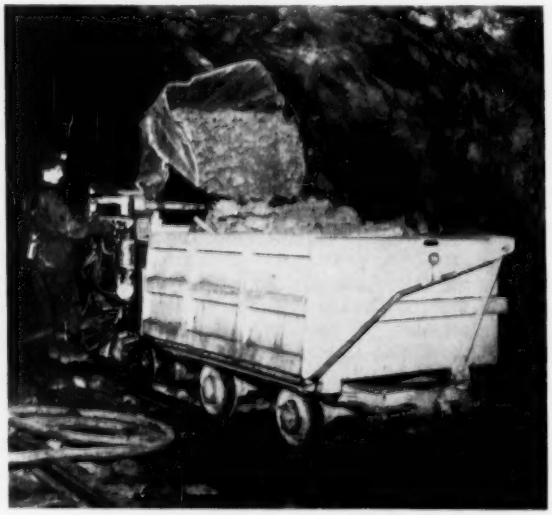
PROS AND CONS OF SCRAPER USAGE

Scraper equipment enjoys certain advantages, namely that it can shovel all types of material, can clean up fairly satisfactorily, even close to the face, and is of simple and sturdy design.

It is easy to operate, and has low repair costs. Track laying is only necessary once, when moving the hoist, the unit can load on curves, and has a low initial cost.

The disadvantages are that scrapers have a relatively limited momentary capacity, considerable time is necessary for setting up before mucking and for moving afterwards, and incompletely broken rock in the face cannot be dug out or loosened.

Loaders include the Joy Longwall Loader, where the feed is effected by two collecting arms or claws which are situated at the forward end of a scraper ramp and work with an eccentric movement, while the Goodman Manufacturing Company, Chicago, makes a small loader which



Other angle view of Atlas Copco LM200 at Malmberget, Sweden

is included among the shovel loading machines. The firm also manufactures a larger machine which may be placed in a separate category, on account of special features. This loader is track mounted. It has a bucket fixed to a short arm and constructed in the form of a trough, with the rear end of the arm attached low down to the front part of the machine. The filling operation is much the same as with shovel loading machines; the whole machine moves forward on rails and works the bucket into the broken rock. When the bucket is raised after filling, the muck runs down through the trough on to a strong rubber belt for conveying to cars or trucks.

The Shaking-pan Loader or Vibratory Loader consists of a trough which is vibrated by special machinery. At the front the trough is shaped in the form of a shovel which vibrates its way into the muck, or in some cases may be driven in. The vibratory effect causes the material to move up the trough and into the cars. The design has not yet been developed to such a point that the machine is suitable for use with hard rock.

TYPES OF HAULAGE CARS

It is difficult to employ any other than track mounted equipment for hauling broken rock in the smallest tunnels. Under special conditions, however, and particularly in mines, rubber tyred vehicles can be used. The commonest type of car used hitherto is the Decauville type. With an overall length of approximately 5 ft., it can only take 12.4 to 17.7 cu. ft. of solid rock. On small-scale operations, however, Decauville cars have two advantages. They are easy to tip and are cheap in initial cost.

The first step in the development away from this type of car is the so-called Granby car. But this type, too, is generally unsuitable for use in small tunnels.

A type of car that may be regarded as a useful development of the Granby car, however, has a so-called shell construction, with capacities from 3 to 8 tons. Such cars are becoming increasingly used, and can take large loads in relation to their dimensions.

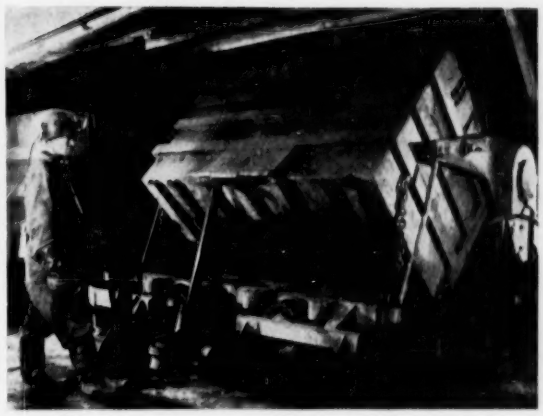
An entirely new type is the Joy shuttle car. This car is self-propelled and is fitted with a special drive for its belt-conveyor bottom. The model so far available in Europe has a capacity of 18 tons.

The switching problem can be simplified if the tunnel width can be increased so as to make it possible to lay a double track and change over the cars immediately at the loading point. A double track may either be laid along the whole length of the tunnel, in which case car changing is effected by any of the above-mentioned switching equipment, or else a single track may be laid and a portable type employed, such as the California switch.

EMPHASIS ON AUTOMATIC TIPPING

Recently two new loading methods have been evolved which eliminate car changing. These two methods employ entirely different principles, using either a conveyor belt of some kind, or else loading from a scraper over the cars. The first method has been applied in a design produced by the German firm of Salzgitter, in another form by the Swedish State Power Board for the construction of a power station by Bergeforsen, while the second method has been developed in the mines of the Boliden Mining Company.

The method of tipping adopted is determined by local conditions, the design of the cars and the purpose to which it is intended to put the excavated rock. When the rock cannot be placed on a dump directly outside the tunnel portal, for subsequent removal in one operation, it is preferable to arrange a central pocket from which it can be loaded.



A 140 cu. ft. Granby car being tipped pneumatically by an air cylinder of 15½ in. dia.

For automatic tipping, cars of the shell type may be fitted with an arm which projects at one side and is provided with a roller at the end. When the car reaches the dump this roller engages with a guide, raising the car body on that side. At the same time the opposite side is opened by coupling rods and the load is dumped. The underframe is held in position by another guide. With car couplings fixed to the underframe, the entire train can be tipped without uncoupling the cars.

Another form of automatic tipping employs compressed-air cylinders and tilting hooks which engage the car bodies. The cars are then tipped either on a special platform or by tilting against one of the rails. Such tipping devices can also be used when the height of the car bottom above the rails is very low. They are best installed over a fixed dump, but may also be made in a portable form for tipping on a chute.

Automatic tipping devices are also available in the form of a rotary cage into which the cars are driven. In most small-tunnel work tipping is a relatively insignificant item in so far as the planning of a loading schedule is concerned.

LOADING AT BOLIDEN

The entire work of loading can be organized so as to avoid interruptions for changing cars. One way of accomplishing this has been developed at Boliden, where scraper equipment is employed. A train of as many cars as are needed to load an entire round, is placed behind the scraper. The upper edges of the cars' sides are made of strong angle iron with the lower flange turned towards the inside of the car. When the cars are placed close to each other, the angle irons form continuous guides over which the scraper can be drawn along the whole length of the train. The scraper first fills the car nearest to the hoist and is then drawn over the guides to the next car. When all the cars have been filled, a heaping load is filled first on the last car, then on the next from the end, and so on. When the whole round has been loaded the train is hauled out for dumping. This method of loading meets most requirements for loading in headings of small area such as 54 sq. ft.

The objection might be raised that the momentary capacity of a scraper is relatively low, but the reliability in operation and practical capacity of the method are excellent. Both the initial cost of the equipment and the operating and maintenance costs are low. The scraper ramp is set up at 13 to 20 ft. from the face for the first round. The scraper is then not moved until so many rounds have been fired that the total scraper length has become about 164 ft.

ENERGY—II.

Future Fuel Supplies in the U.K.

The following article, the second of two instalments, concludes the condensation of the 1955 Viscount Nuffield Paper entitled *Britain's Energy Prospects* and presented to the Institution of Production Engineers on December 15, 1955, by Dr. G. H. Daniel, Ministry of Fuel and Power. The article considers the primary fuels and their potential availability in the United Kingdom, and draws interesting conclusions as to the source of the energy to the equivalent of 210,000,000 tons of coal a year to be provided within thirty years.

The resources of water power in Britain are limited, the bulk of them (sufficient to save about 5,000,000 tons of coal a year at thermal power stations) being in the Scottish Highlands and the total for the whole country being no more than would save 7,000,000 tons of coal a year. The amount already developed is only sufficient to save about 1,000,000 tons of coal a year and most of the remaining potential is relatively costly to develop and more suitable for peak, than base, load operation. Development is, however, going ahead in the North of Scotland and it is possible that by 1970 water power will be saving 2,000,000 tons of coal a year and by 1985, 3,000,0000 tons a year.

NUCLEAR POWER

The prospect for continued growth and prosperity of the population of this and other countries would be brutally short but for the promise of nuclear energy.

Two questions immediately occur, and to both of them there is a reassuring answer. The first is whether there are sufficient reserves of atomic fuels. Until recently no serious search had been made for uranium, but the rate of mineral discovery has probably never been as fast as it has been for uranium in the last two decades. Major commercial discoveries have been made in widely-scattered localities from the refuse heaps of the South African gold mines to Rum Jungle in Australia and from Beaverlodge and Blind River in Canada to Laguna and Poison Canyon in New Mexico. There are important deposits in the Congo, Central Europe, Utah, and many other places.

Although exploration is still in its early stages, the known reserves of the producing nations of the West alone include over 1,000,000 tons of uranium that can be produced at a cost of less than £4 per lb. for U_3O_8 in high-grade concentrate. Several million tons more can be produced at up to £10 per lb. and there are very much larger quantities (including, for instance, the enormous phosphate and shale deposits of Mexico, the United States and the Baltic countries) which have lower concentrations of uranium but which may still be commercially worth working, particularly if associated minerals—for instance, shale oil—are exploited at the same time. The known reserves have, in fact, a heat content several times greater than the world's total reserves of the conventional fuels and the uranium production already developed suffices for a world-wide programme of nuclear power development.

There are in India, Ceylon, Brazil, the United States and elsewhere important reserves of thorium, which has good prospects of use in advanced types of reactors. Moreover, there is a chance of securing the controlled release of energy from nuclear fusion, so enabling light elements like deuterium and lithium to be added to the list of fuels.

The second question is whether, setting aside the dangers of large-scale manufacture of atomic armaments, nuclear power can be developed without serious risk to health. Theoretically, a reactor disaster could release large quantities of radio-active materials and while these might cause no more immediate casualties than would an accident to a large chemical works, they could interfere for a much longer time with the livelihood and homes of the local population. Fortunately, reactors of a self-regulating character can be designed and techniques of inspection and control are well developed. Although safety precautions must remain a vital consideration, there is no reason to think that the dangers of an explosion will prevent the development of this form of energy.

We may hope that nuclear energy will be replacing 6,000,000 tons of coal by 1965 and perhaps 40,000,000 tons of coal by 1975.

Thereafter, it seems possible that all new generating capacity will be of this kind, there being no problem of restricting nuclear stations to base load operation because by then their capital cost will have fallen close to that of conventional stations, and stations will have been developed of a type sufficiently flexible for medium load operation. On this basis nuclear energy would be doing the work of 94,000,000 tons of coal a year by 1985, and would then constitute nearly two-thirds of the fuel consumed at power stations. In addition, nuclear energy is likely to be developed for other purposes—in particular for ship propulsion and as a source of heat for industrial plants with a large process and space-heating requirement.

There are a number of other sources of energy that are being investigated at present or are being developed on a pilot plant scale.

Some of these, for instance, those aiming at direct use of solar energy and the fuel cells which aim at direct production of electrical energy and the freeing of power production from the limitations of the Carnot cycle, would, if successful, have a significance comparable with the development of nuclear energy. The discovery of large quantities of natural gas would revolutionize the prospects of the gas industry. But these possibilities are still remote. Others—for instance, underground gasification, peat utilization, methane drainage and wind power—offer more definite prospects of a small but still useful contribution to energy supplies during the next two or three decades.

CONCLUSIONS

Having surveyed the problem, what can now be said about the possibilities of supplying enough primary fuel to meet the growth in demand for energy during the next thirty years? If economic expansion is no faster than in the inter-war period, there should be no shortage of fuel though there will be various problems of adjustment as the newer sources are developed; a moderate increase in oil during the next decade and, thereafter, a modest nuclear power programme, should suffice to make up for any deficiences in coal supplies. But can supplies be made available to sustain an expansion fast enough to enable the standard of living to be doubled in a generation?

The estimates suggest that the maximum increase in inland fuel requirements that might be expected under these circumstances is from 245,000,000 tons of coal equivalent in 1954 to 458,000,000 tons in 1985. Detailed consideration of the factors determining consumption and of the prospects in individual sectors suggests that this increase is too big, but it may be adopted in order to be on the safe side.

By adding bunkers and an arbitrary figure of 10,000,000 tons for coal exports, the highest estimate of the total demand it seems reasonable to consider is one rising from 269,000,000 tons of coal equivalent in 1954 to 329,000,000 tons in 1955, 397,000,000 tons in 1975 and 479,000,000 tons in 1985. The nuclear power programme now in hand is hoped to contribute the equivalent of 40,000,000 tons of coal a year by 1975 and a further extension to 94,000,000 tons a year by 1985 would seem possible. Satisfaction of the growth in oil demand would increase energy supplies from the equivalent of 38,000,000 tons of coal in 1954 to 155,000,000 tons in 1985. Finally, the expansion of hydro-electric capacity, use of nuclear power for ship propulsion and process heating and development of new techniques like underground gasification might contribute at least 5,000,000 tons of coal equivalent a year by the end of the period. The part of demand remaining for coal would then rise from 230,000,000 tons in 1954 to a peak of about 240,000,000 tons in 1970. Only in the following years would the pressure on coal be eased by the massive injection of nuclear power and fifteen years later in 1985 the demand for coal would still be about 225,000,000 tons.

DIFFICULTIES BESETTING COAL

Marshalling of supplies in this way would satisfy the biggest demand that need be envisaged, and at first sight the figures seem very reassuring since they indicate a task for the coal industry that is below the target of 240,000,000 to 250,000,000 tons that the National Coal Board has set itself. But this gives no grounds for satisfaction. The experience of the last four years has given a good hint of the difficulties of expanding coal output. Output in 1955 is likely to fall slightly short of that of 1951. Large investments will be needed for many years if 225,000,000 to 240,000,000 tons a year of reasonably priced coal are to be produced over the next thirty years.

With other industries, whose competitive position is stronger, striving to grasp more labour, mining manpower may go on declining, and great efforts will be needed to offset this and the natural loss of mining capacity. As standards of living improve the miner will want to reduce his hours of work and increase his holidays. Moreover, this year's likely total output of about 222,000,000 tons of coal includes a substantial marginal tonnage that cannot be maintained indefinitely ; besides the output from high-cost mines, it includes over 11,000,000 tons of coal got on Saturdays and over 11,000,000 tons from opencast.

Contemplation of the contribution assumed from oil and nuclear power destroys any lingering sense of complacency. The Atomic Energy Authority and the oil companies between them are being counted on to carry out the stupendous task of providing in the space of thirty years, new sources of energy equivalent to over 210,000,000 tons of coal a year.

Obviously, much hangs on the success of Calder Hall and its successors. Even the amazing capacities of the oil companies will be taxed to execute the plans that have been made for the expansion of oil supplies during the next decade and to provide for further growth thereafter. The companies will have to overcome great difficulties in discovering sufficient new supplies of inexpensive crude oil and in coping with the likely shift in the balance of demand for the main products. The import bill for oil will rise to impressive levels. Inability of the companies to meet the whole of the demand for oil or of the nation to earn enough from its export trade to pay the bill would shift more responsibility on to coal. The latter would have to take the place of fuel oil and possibly, by means of oil-from-coal plants, supplement the supply of light oils and middle distillates.

Radio Link Aids Cementation Operation

A radio link has been established between the head office of Boart and Hard Metal Products (S.A.) Ltd., in Johannesburg, and the Orange Free State branch of the company, according to a report published in *Optima*, Vol. 5 No. 4, a quarterly review published by the Anglo American Corporation of South Africa Ltd.

This branch, operating at Welkom, is responsible for cementation in the Orange Free State mines of the Anglo American Corporation Group. By this is meant not only the normal "covering" process of injecting cement into the rock ahead of shaft-sinking or development excavations in ground where water-bearing fissures are known or believed to exist, but also emergency action in pumping large quantities of cement into water-bearing fissures that have been unexpectedly intersected.

One of the biggest problems in establishing the gold mines in the Orange Free State has been the large amount of underground water encountered in shaft-sinking and development; on a few occasions the influx of water has been sufficient to flood the workings so quickly that neither cementation nor the normal pumping equipment could stem the flow before the shaft or development end was temporarily "lost". Subsequent action, apart from such emergency measures as the local mine managers could take, has then depended upon the decision of the consulting engineers, who are normally in Johannesburg.

The Orange Free State mines are roughly 150 miles from Johannesburg. There is, of course, telephonic communication between the centres, but delay in taking effective steps when a shaft is flooding, however, could be very serious; it would probably mean the postponement of gold production by a new mine.

In recognition of the importance of having immediate communication between the Welkom and Johannesburg offices of Boart and Hard Metal Products, the Postmaster-General granted an application for a licence to operate a radio link between the two centres.

SIMPLICITY OF OPERATION

The equipment for this link is quite simple. At each end of the link is a small transmitter and a receiver. The transmitters, built by a suitably qualified member of the company's staff, are crystal controlled to ensure frequency stability, and they operate at a power input of 100 w. Commercial communications receivers are used.

Simple aerials (half-wave folded dipoles) have been found to give effective two-way communication since the link was put into operation a few months ago. One advantage of this simple type of aerial, compared with more elaborate beam aerials, is that it can be slung inconspicuously over the inner courtyard of the Anglo American Corporation's 14-storey building at 45 Main Street, Johannesburg. At the Welkom end of the link the aerial is supported by 40 ft. masts.

When the radio link was first put into operation it was manned by experienced radio operators. The equipment is so stable and simple to operate, however, that non-technical staff at each end of the link quickly learned the procedure for operating radio telephony, and are now able to keep the link open between Welkom and Johannesburg without technical assistance, except in a breakdown.

The radio link has already proved its value in allowing urgent administrative instructions to be passed quickly to the Orange Free State.

Underground Dump Haulage on Incline

The Joy Car Spotter, manufactured by Joy-Sullivan Ltd., has been developed for underground use as a dump haulage unit, and its first application was in Elliot Colliery, South-West Division of the National Coal Board, in 1954. Since that time many of these units have been installed in other collieries—in surface as well as underground installations—and a second unit was put into service at Elliot Colliery early in 1955. The following article describes the operating principles and construction of the Car Spotter, as well as the particular operational methods on the Elliot Colliery site.

Joy Slusher Haulages in their various sizes from 25 to 150 h.p. have a wide application in scraping, slushing or scraper packing. In slusher uses, however, the load is essentially dead; the bucket or the hoe box can be counted on to remain standing if the drive is disconnected or current fails.

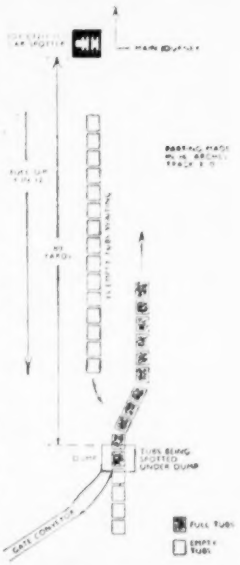
In handling tubs or cars against gradient the difference between the hoist and the slusher becomes apparent. In the former, load-holding brakes are a necessity, while in the slusher, braking action is necessary only to control surge on one drum while the other is hauling. The latter are preferably automatic brakes, weight or spring controlled, using the servo principle to put the necessary tension in the brake band.

The Joy Car Spotter is to outward form the same general design as the slusher, with heavy duty positive brakes added. These must be capable of absorbing even greater power than the fabric-lined bands on the combined epicyclic clutch and reduction gear driving the drums. The brake gear must also be able to withstand shock loads encountered when a heavy load is in motion downgrade and has to be arrested and held.

HEAVY SHOCK LOADS

Less apparent than the outward and visible addition of efficient brakes is the provision for absorbing the increased loads on driving shafts and gear. In slushing work the loads are heavy and provide plenty of shocks, but the load will yield, or the operator can handle his machine in such a way as to protect it, when snags are encountered. The haulage or hoisting load starts off as a dead lift calling for maximum torque at the outset. In a slushing or similar load the bucket starts out empty and builds up to full load with a correspondingly easier duty for the friction clutches and epicyclic gear.

The first specification for the Spotter envisaged hauling 40 tons of dead load, tubs and coal, from rest against a 1 in 10 slope for a distance of 125 to 150 yd. It was required to be powerful, compact, and a readily movable unit to replace a powerful, but extremely bulky and heavy, air haulage of approximately 75 h.p. They were to be used for drawing a set of tubs past a dump loading point, inching each tub twice, and hauling the entire set against the grade to the main endless rope haulage in the main gate. Electric power was readily available in the haulage road. The existing haulage required a long air lead of substantial size to feed its two 12 in. bore cylinders.



The Joy Car Spotter

At Elliot Colliery the Car Spotter is situated about 80 yd. on the rise side of the dump (gradient 1 in 12). An empty journey of 15 tubs, each 25 cwt. capacity and weighing 10 cwt., is allowed to gravitate under the dump. Each tub is spotted under the dump by hauling up the incline with the friction clutch, an average of two moves being required per tub.

Operational site of Joy CF211 (CS) at Elliot Colliery, S.W. Division, N.C.B.

As the journey is being filled, it is hauled up the " full " side of the parting. This operation is carried out on one drum of the Car Spotter while the second drum is attached to another 15 empty tubs waiting to be let down the gradient. The first 15 tubs are also full. The two sets are then coupled together and taken out by the main pit haulage, which in the meantime, has put a further 30 empty tubs on the " empty side ".

A shift's output of 450 tons is handled in this way with a ¾ in. dia. rope being used on the Car Spotter haulage. With a 11/16 in. dia. rope, however, it is not necessary to split the journey of 30 tubs into two sets of 15, since the whole load can safely be taken at once.

In the installation described above, it is significant to note that over a period of nine months' operation no repairs of any sort were necessary.

DIMENSIONS OF THE UNIT

The Spotter is built as a unit which can be readily skidded into position on a previously prepared foundation and bolted down without loss of production time, and its width can be accommodated in a normal road, alongside the rails, without cutting a special chapel.

The maximum rope pull of 10,500 lb. is available at a speed of 180 f.p.m. with the 60 h.p. continuously rated motor. The 75 h.p. will handle the same load at a speed of 225 f.p.m. but the motor is one hour rated. Higher speeds up to 340 f.p.m. can be used by selection of alternative gear ratios, with a corresponding lowering of the deadweight pull.

The overall dimensions of the machine are : width 7 ft., depth 3 ft. 9 in., height 3 ft. The base plate requires only 4 ft. 6 in. x 3 ft. 6 in. ground space, with the flange-mounted motor overhung at either the left or right side.

TECHNICAL BRIEFS

Nickel Chromium Sheet Heating Elements

Lindberg Engineering Company, United States, has announced introduction of "Corrtherm," a new electric heating element for heat treating furnaces. This element consists of corrugated sheets of nickel chromium and was developed by Lindberg metallurgists and engineers after several years experimentation and testing, according to a report in *American Metal Market*.

The elements are large sheets of corrugated nickel chromium which practically cover the entire walls of the furnace. These sheets are hung from alloy hooks extending through the roof, making the installation and replacement extremely simple. No supports or hangers need to be built into the walls.

The large size is necessary to accommodate amperages 10 to 20 times greater than in the previous types of elements. The greater surface area results in lower surface temperatures and therefore longer element life.

As often happens in new developments other advantages result. An important advantage is said to be safety for the operator. Another highly important and completely new advantage of the new element is that in forced convection furnaces where high temperature fans force the hot gases through the charge being heated, the elements act as a direction baffle, heating the gases at the same time.

It is anticipated that the Corrtherm element will bring electric furnaces in competition again with fuel furnaces in the field of carburizing and carbonitriding. It is also expected that the use of electric furnaces will expand even faster in the other fields where they are already a major factor.

Techniques for Hafnium

Hafnium metal, important to the atomic energy field, can be produced in the same equipment used for making its sister substance, malleable zirconium, the metal which has proved so valuable in constructing nuclear reactors, according to a report from the U.S. Bureau of Mines.

Techniques for producing hafnium were developed by the Bureau at its Northwest Electrodevelopment Laboratory, as part of an Interior Department programme to recover rare metals from domestic and foreign ores in co-operation with the Atomic Energy Commission and the U.S. Navy.

Hafnium and zirconium have widely different characteristics in the field of atomic energy. Zirconium does not absorb neutrons and thus is used as a structural and cladding material in nuclear power units, the most prominent one being in the submarine *Nautilus*. Hafnium, on the other hand, absorbs neutrons so effectively that it can be used as a radiation shield.

To meet AEC requirements the Bureau of Mines created a process for making hafnium-free zirconium. The high grade hafnium product of the process is treated to yield pure hafnium, which is now produced in sufficient quantities for testing its usefulness on a large scale.

The Bureau also reports that the oxide and carbide of hafnium have extremely high melting points and thus might have some future role in jet engines.

Tungsten Carbide Cladding

A new method of applying thin layers of tungsten carbide to steel surfaces has been developed by the Carboloy Department of General Electric Co., United States, whereby its tungsten carbide is said to form a metallurgical bond with the base material. The technique is still in the appraisal stages, but is claimed to be different from other methods developed for carbide coating in that it provides a truly sintered carbide structure.

To date, Carboloy engineers are reported to have been successful in coating such items as capstan rings drilljig bushings and cylinder linings, the coatings being applied in thicknesses up to 0.03 in. Besides providing coated parts with the wear-retarding qualities of cemented carbides, the method may also overcome certain design limitations associated with solid carbide parts.

REVIEWS

Tungsten, *by K. C. Li and Chung Yu Wang. Published by the Rheinhold Publishing Corporation, New York, and Chapman and Hall, 37 Essex Street, London, W.C.2. Price* 112s. *nett.*

This is the third edition of the famous monogram prepared by Li and Chang for the American Chemical Society. It covers every aspect of the subject and has been brought up to date. Though one of the most important strategic metals, tungsten is a comparative newcomer to industry.

The world's greatest source of tungsten was accidentally discovered by Li in 1911, while exploring for tin in the south-western part of China. Since 1915 China has been the world's leading producer, a position she will assuredly hold for many years to come, since her reserves have been estimated at approximately ten billion pounds of WO_3. Due to the exigencies of the second world war, however, and the blockading of the pre-war regions of supply, the centre of tungsten production has shifted from the East to the West. The fact that demand has hitherto been geared predominantly to war production has resulted in violent price fluctuations. The highest price paid for tungsten ore during the past 25 years was 14 times the lowest price.

As Chairman and Chief Engineer of the Wah Chang Corporation and Chief Engineer of the Wah Chang Smelting and Refining Co. of America, Inc., Li has played a leading part in the development of tungsten as a war and industrial metal. It would be a mistake, he believes, to assume that tungsten is only a strategic material. Besides its use in high speed steel cutting tools, colours, lamp filaments, wireless valves, X-rays, catalysts, and camera lenses, he is of the opinion that there are many other fields in which tungsten could well be used.

The latest edition of the monograph covers every aspect of the history, geology, ore dressing, metallurgy, chemistry, industrial applications, substitution and economics of tungsten, and is fully annotated.

Winding Engine Calculations for the Mining Engineer, Second Revised Edition, *by A. B. Price, B.Sc., A.M.I.Mech.E. Published by Fraser & Chalmers Engineering Works of The General Electric Company Limited. Pp.* 150 *and with illustrations. Price* 30*s.*

This title was originally published in 1951, and since that time the work has been revised to include more details of friction winders of both Koepe and multi-rope types.

The complexities of design are discussed at length with particular reference to the problems of the site engineer, and an effort has been made to deal with practice both in the United Kingdom and overseas. All systems at present practised are noted and a chapter on control schemes is useful in orientating the calculations to particular problems.

For drum winders, calculations are given relating to cylindrical drums, B.C.C. drums and double drums; on friction winders, Koepe wheels and multi-rope winders are fully described. A chapter is included on inclined shafts in which the mechanics of this method are considered. Calculations for steam winders form an end piece to the book. Useful tables are included on ropes and also on moments of inertia for typical A.C. and D.C. motors, drums and reduction gears.

The book is being dispatched to colliery winding engineers in the United Kingdom and abroad. In addition, copies have been sent to County Librarians in the coal mining counties, and to the librarians of universities and mining schools in the United Kingdom. The Company have donated a number of copies to the Electrical Industries Benevolent Association, of 32 Old Burlington Street, London, W.1, to whom application may be made for copies at the published price.

Concluding Report on the International Congress for Ore Dressing, Goslar 1955. *Published in German. Pp.* 274.

This publication, a supplement to Vol. 8 (1955) of *Zeitschrift fur Erzbergbau und Metallhuttenwesen*, appeared as an extra supplement in November of this year and contains the various lectures and discussions which took place in Goslar from 8-11 May, 1955.

COMPANY NEWS AND VIEWS

Witbank Despatches More Coal

During the year ended August 31, 1955, Witbank Colliery despatched a total of 1,762,637 tons of coal as compared with 1,610,500 tons during the previous year. This increase was due to extended operations in the Wolvekrans section. Output from the Southern section was lower by 10,710 tons.

Year to Aug. 31	*Working profit*	*Taxation*	*Net profit*	*Dividends*	*To reserve*	*Carry forward*
	£	£	£	£	£	£
1955	267,575	70,715	92,373	77,000	46,637	156,100
1954	265,799	69,751	150,290	67,375	177,409	92,373

An interesting comment regarding the past financial year's operations appeared in the company's directors' report. This stated that although production had been periodically curtailed there had been some improvement in the position as compared with previous years. The large capacity of the new stockpile had enabled production difficulties formerly experienced during periods of fluctuating truck supplies to be alleviated.

Mount Charlotte in 1954-55

In his statement to shareholders of Mount Charlotte (Kalgoorlie) Gold Mines, Mr. Thomas Kenny, the chairman, expressed his regret that the Champagne Syndicate, N.L., who purchased the company's mine in 1953, had not yet started work on the property. Although there was no indication that operations would start in the near future he was hopeful that the delay would not be too long. As shareholders were aware, no further payments would be received from the purchasers until that time.

During the past financial year ended August 31, 1955, Mount Charlotte made £1,545 as compared with £1,811 during the previous year. The adverse balance as at the year end was £96,904 (£97,418).

Strike May Close Taquah and Abosso Mines

Mr. Robert Annan, chairman of Taquah and Abosso Mines, has recently sent a cable to the Permanent Secretary Ministry of Trade and Labour, Gold Coast Government, stating that as a result of the strike of African employees, the company was no longer in a financial position to keep the mine open. It had therefore been decided that unless work was resumed by noon on Monday, January 16, 1956, notice would be given to all employees that pumping would cease and underground workings allowed to flood. Should this happen, Mr. Annan continued, it would be impracticable to re-open the mine. Plant and stores would therefore be sold.

Van Ryn's Sub-Participation in Bancroft Loan

Addressing the recent meeting of Van Ryn Gold Mines Estate, Sir George W. Albu, the chairman, referred to a sub-participation which the company had taken in respect of a loan to Bancroft Mines. As a result of this sub-participation which was limited to £40,000, Van Ryn had been granted an option exercisable on or before June 30, 1958, to take up 20,000 shares in Bancroft Mines at 37s. 6d. per share.

Meru's Smaller Loss

In his statement to shareholders of Meru Tin, Mr. G. A. Williamson, chairman, said that the company's loss during the twelve months ended June 30, 1955, had been less than one-fifth that of the previous year. Mining operations, he emphasized, had shown a small profit and the deficit had been due to London expenses which included interest on the outstanding balance of the company's rehabilitation loan. Referring to production during the past financial year Mr. Williamson stressed that an additional 100 tons of tin concentrates had been won. But only a small proportion of this had come from the section worked by the company itself; the rest had been produced by tributors. Meru Tin had recently opened up a fresh section which it was mining on its own account. Although a severe drought had given this new mine a bad start, it was now yielding a satisfactory output.

As the Markets were closed over the Christmas holiday, our two regular features—Metals, Minerals and Alloys, and Mining Markets—are not appearing this week. They will be resumed in our next issue.

Tekka-Taiping May Return 5s. Per Share

At the extraordinary general meeting of Tekka-Taiping it was decided not to reduce the company's capital by a return of 2s. 6d. per share. It was, however, agreed that steps should be taken to ask shareholders to authorize such a reduction in capital as would enable a return of 5s. per share to be made.

RECENT INTERIM DIVIDENDS

Name of Company	*Year ending*	*Dividend*	*Date Payable*	*This Year to date*	*Total Last Year*
		%		%	%
Cons. S. A. Lds. ..	30.6.56	7½	Dec. 31	7½	17½
Dom. Reefs	30.6.56	25	Feb. 11	25	Nil
Tvl. Nav. Colls.	30.6.56	5	—	5	10

RECENT FINAL DIVIDENDS AND PRELIMINARY FIGURES

Name of Company	*Year ended*	*Final dividend*	*Net Profit after Tax This year*	*Net Profit after Tax Last year*	*Total Dividend This year*	*Total Dividend Last year*
		%	(£000)	(£000)	%	%
Apex Mines ..	31.12.55	30	N/A	N/A	55	55
Cons. Diamond *a* ..	31.12.55	100	13524.0	10776.8	150	150
De Beers Ind. ..	31.12.55	10	822.7	562.8	10	10
Amal. Colls. S. A. *a*	31.12.55	6¼	765.0	736.9	17½	17½
New Kleinfontein ..	31.12.55	1¼	N/A	N/A	2½	7½

a Profit figures *before* tax.

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GOLD FIELDS RHODESIAN DEVELOPMENT CO.

The 43rd annual general meeting of The Gold Fields Rhodesian Development Company, Ltd., was held on December 20 in London.

Mr. Robert Annan, chairman, in the course of his speech, said: The profit before taxation at £41,294 shows a fall of £22,083. This is the net result of a decline of £28,618 in revenue and of £6,535 in expenditure compared with the previous year.

Out of an available balance of £60,645 your Directors recommend the payment of a dividend of 5 per cent., less tax, costing £36,142 net, and leaving £24,503 to be carried forward.

When I addressed you last year I reported the decision of your Directors to cease prospecting activities in Southern Rhodesia, except for completing the development of Sebakwe, and to concentrate on the investment side of the business. Subsequent developments have caused us to modify this view. You have now received a circular in connection with the offer which is being made to you for your shares which contains a list of our principal investments. From this you will see that they are divided between mines paying dividends and mines still in the stage of development.

MOTAPA AND SEBAKWE

Our problems lie in the operations of Motapa and Sebakwe. At Motapa, temporary difficulties have occurred during the past year owing to shortage of power following a breakdown in the Bulawayo power plant and to trouble with the roasting plant at the mine. The main trouble, however, is that development in depth has run into a poor zone in which the size of the ore bodies has greatly diminished. It is possible that conditions may improve again at greater depth but there can be no certainty of this. The continual rise in costs has rendered this mine a marginal proposition and the cost of development is considerable in relation to the revenue.

In these circumstances an approach has been made to the Government for financial assistance in carrying on development. However, unless development results and operating conditions generally undergo a marked improvement, of which there is no sign at present, the future outlook for this mine is not good.

At Sebakwe, development has been carried on at an increased rate and the greater part of the cost in the past year has been covered by the results of milling on a small scale. The proved reserve at October 31, based on a pay limit applicable to such a scale, say 5,000 tons per month, was only 13,850 tons averaging 15.24 dwt. gold per ton. On a small scale operation a higher pay limit would apply and in these circumstances we do not feel justified in putting any value on this venture as even a salvage operation would be attended with considerable risk.

It is difficult for a small mining finance company requiring dividends to take long views and embark on ventures which to an ever-increasing degree, require heavy investment and a long time to bring to fruition. Any disappointment has a disproportionately greater effect but neglect to secure new business can only mean the gradual liquidation of the assets. These arguments do not apply to larger concerns with adequate capital and the ability to spread their risks and which have far better prospects of continuing prosperity.

OFFER FROM GOLDFIELDS

With these considerations in mind your Directors have secured from the Consolidated Gold Fields of South Africa, Ltd. an offer to acquire your shares by an exchange on the basis of one Ordinary Share of that Company for six shares of your Company. We have now no investment of any importance which is not held on a much larger scale by the wholly-owned operating subsidiary of Gold Fields. The circular which was sent to you on December 12 gives full details of your assets and of the offer. You have also received a copy of the Gold Fields' Report and Accounts and if you take into account the figure shown for the Stock Exchange value of its investments you will readily appreciate how much the backing for your investment will be improved by making the exchange. Where our investments have improving prospects, these will remain in greater degree after the exchange owing to the greater proportionate holdings of Gold Fields.

By making the exchange the Stock Exchange value of your present share becomes 9s. 7d. compared with 6s. at the time when the offer was announced, the current rate of dividend is slightly improved but with incomparably better cover, and the underlying value of the assets is much higher. On these grounds your Directors strongly recommend acceptance. The offer remains open until Thursday January 12, 1956.

The Report and Accounts were adopted after the chairman had replied to questions and comments.

MOUNT ISA MINES

MR. G. R. FISHER'S REVIEW

The Annual General Meeting of Mount Isa Mines, Ltd., was held on December 6 at Brisbane, **Mr. G. R. Fisher** (Chairman of the Company) presiding.

The Chairman, in the course of his speech, said:—The nett profit for the year ended June 30, 1955, was £3,307,250, compared with £2,096,204 for the previous year and was struck after providing £800,000 for depreciation of buildings, plant and machinery and £941,250 for Income Tax.

From profits for the year, the Directors have recommended payment of a final dividend of 15%, absorbing £863,597. This is in addition to the interim dividend of 10% paid on June 29th, which required £575,731. The total dividend disbursement for the year amounted to £1,439,328 out of nett profit.

The dividend policy has been dictated by the increasing need for substantial capital development both for existing operations and for the very substantial mine development which is being planned. The present policy is to finance these expenditures from profits and reserves.

Stockholders have been advised previously that the possibility of erecting a Zinc Smelter in Australia to handle production from Mount Isa Mines is being examined.

An examination is also being made of the possibility of constructing a copper refinery to treat blister copper from Mount Isa Mines Ltd.

ORE RESERVES

Estimated reserves of silver-lead-zinc ore as at June 30 last were 12,200,000 tons of which 1,900,000 tons were classed as developed ore and 10,300,000 tons as prospective ore. This is an increase of more than 2,000,000 tons over the reserve shown a year ago.

Exploration and development during the year also increased copper ore reserves by approximately 1,500,000 tons, bringing the total to 5,100,000 tons of 4% ore.

URANIUM PROSPECTING

The Company has continued an active ground prospecting programme for uranium in the Mount Isa/Cloncurry area with the assistance of an airborne scintillometer. So far, no deposits of economic importance have been discovered by the Company and, consequently, no further action has been taken regarding the construction of a uranium treatment plant at Mount Isa.

EXPLORATION AND DEVELOPMENT

More exploratory diamond drilling and underground development were carried out in the year under review than in any other year in the Company's history. This drilling, both from the surface and from underground, has added considerably to our knowledge of the extent of known orebodies and has strongly indicated the existence of large new copper orebodies. One intersection revealed an economic width and grade of copper ore, and further drilling is in progress to yield information about the dimensions of this orebody. Very large quantities of low-grade silver-lead-zinc material at the north end of the Black Star section have been proved, and the limits have not yet been reached by drilling now in progress.

Sinking of the AW84 exhaust ventilation shaft, No. 2 Ore Shaft and Davidson Shaft have continued during the year.

At the Northern leases, twelve miles north of Mount Isa, further core drilling showed no diminution of the silver-lead-zinc mineralization with depth. Shaft sinking was hindered by strong water flows and methods of draining are being put into operation before underground exploration is continued.

THE OUTLOOK

At the present time world metal prices are extraordinarily high, but it is not anticipated that these prices, particularly that of copper, will continue at this level. Due to lack of refining capacity in Australia it has been necessary for this company to export blister copper to the United States for refining and for us to bring the copper back to Australia to meet local requirements.

There has been a shortage of copper in Australia during the last year or so, and it has been necessary to import substantial quantities from overseas. In recent weeks there has been a marked decline in the consumption of copper in Australia, but it is anticipated that local consumption will increase in the near future and that all Mount Isa's copper will be marketed in Australia.

I would say finally that provided no unforeseen interruptions occur in our mining and smelting operations, shareholders can look forward to their Company having another successful year.

The Report and Accounts were adopted.

THE CHAMPION REEF GOLD MINES OF INDIA, LIMITED

At the Annual General Meeting held at the Head Office of the Company, Oorgaum, Mysore State, on December 13, **Mr. M. A. Sreenivasan** presided and, in referring to the Directors' Report and Accounts for the year ended December 31, 1954, said:—

"A summary of the receipts and credits totalling £21,003 including £14,600 receivable in respect of the dividend of 4½% declared by the KGF Company, and of the payments and provision totalling £7,411 is given in the Directors' Report. Out of the balance of £13,592 a dividend of 4% totalling £13,000 was declared, and paid on November 4, 1955, leaving an amount of £592 to be carried forward."

Making a reference to his speech as Chairman and the Managers' speech at the Annual General Meeting of the Company's subsidiary, The Champion Reef Gold Mines of India (KGF) Limited, held in September last, Mr. Sreenivasan continued: "You will have noted the results of the working of the Mine for the year 1954 and that production for the first eight months of 1955 was affected by labour strikes and unrest and also in consequence of the shut-down of Biddick Shaft for three months. Production for the months of September, October and November has averaged 14,083 tons of ore milled per month to produce an average of 4,907 ounces per month. As a result of the lower production and in spite of the higher price received for the Company's gold, which for the year to date averages Rs.252/- per ounce, I regret the profit of the KGF Company for the current year will compare unfavourably with that for 1954.

I also covered the subject of the nationalization of the K.G.F. Mines. It is not therefore necessary for me to dwell further on this matter than to mention that there has been no important development since.

Due to the fall in the production of the KGF Company and also to the payments to labour as a result of the recent settlement of the dispute, as referred to in my speech as Chairman of the KGF Company, the overdraft of that Company has risen over the last 10 months. In these circumstances it is unlikely the sterling investments of this Company which are used to support the overdraft of the KGF Company will be released for some considerable time. It is therefore not possible to say when the liquidation of this, the Holding Company, will be commenced."

The Report and Accounts were adopted.

NUNDYDROOG MINES, LIMITED

At the Annual General Meeting held at the Head Office of the Company, Oorgaum, Mysore State, on December 13, **Mr. M. A. Sreenivasan** presided and, in referring to the Directors' Report and Accounts for the year ended December 31, 1954, said:—

"A summary of the receipts and credits totalling £21,875, including £16,951 receivable in respect of the dividend of 6% declared by the KGF Company, and of the payments and provision totalling £8,458 is given in the Directors' Report. Out of the balance of £13,417 a dividend of 4½%, totalling £12,735 was declared and paid on November 18, 1955, leaving an amount of £682 to be carried forward."

Making a reference to his speech as Chairman and the Managers' speech at the Annual General Meeting of the Company's subsidiary, Nundydroog Mines (KGF) Ltd., held in September last, Mr. Sreenivasan continued:—

"You will have noted the results of the working of the Mine for the year 1954 and that production for the first eight months of 1955 was lower, compared with that for the corresponding period of 1954, due to the interruption of production in the early part of the year owing to the fire in the Mine and the unsettled labour conditions. The production for the months of September, October and November has averaged 19,513 tons of ore milled per month to produce an average of 6,233 ounces per month. You will also have observed that the higher price received for the Company's gold and which for the year to date averages Rs.252/- per ounce will, subject to eventualities between now and the end of the year, result in a profit which will compare favourably with that for 1954.

The result of the appeals to the Labour Appellate Tribunal has just been made known. The Appellate Tribunal has upheld the award of the increase in basic wages of three annas per day from April 1, 1954, and has reduced the bonus awarded to one month's basic wages in respect of the year 1952. The Appellate Tribunal has also awarded a Termination Gratuity Scheme.

I also covered the subject of nationalization of the K.G.F. Mines. It is not therefore necessary for me to dwell further on this matter than to mention that there has been no important development since.

Your Directors have given close consideration to the date of liquidation of the Company and the distribution of the investments, to which reference was made in the Chairman's speech last year, and will take the necessary steps as soon as the time is appropriate."

The Report and Accounts were adopted.

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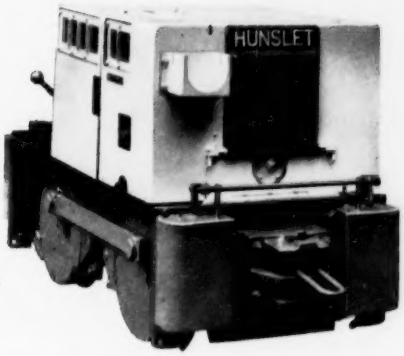

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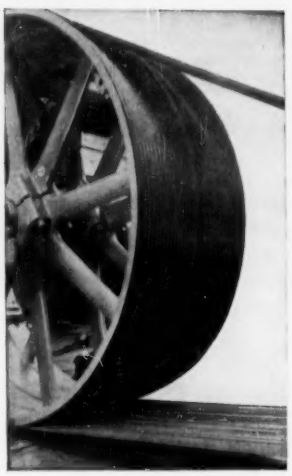

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